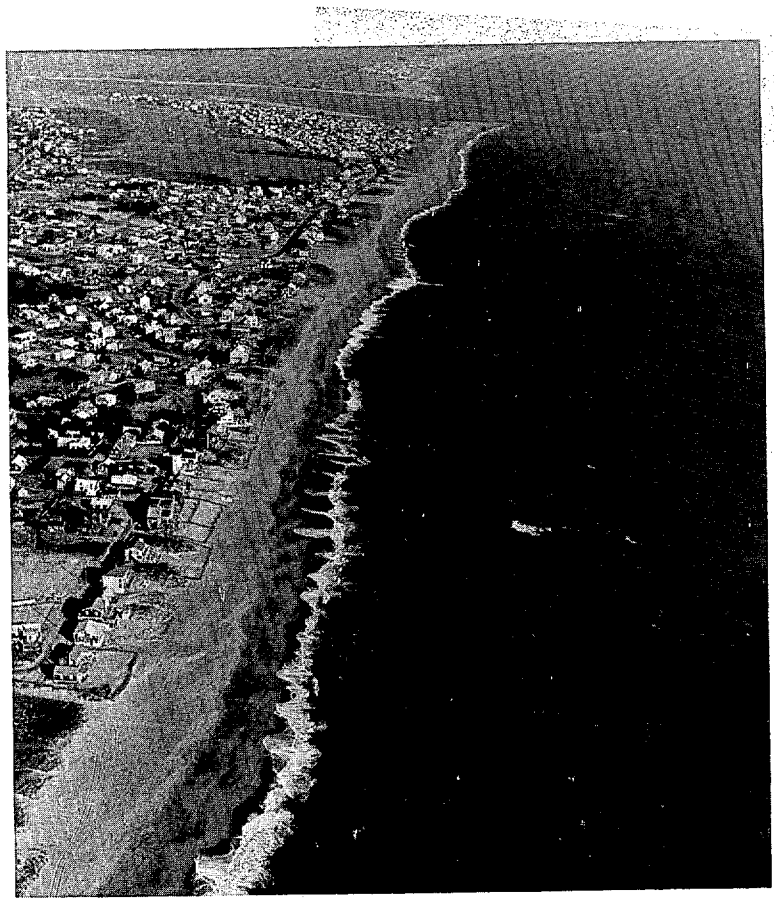
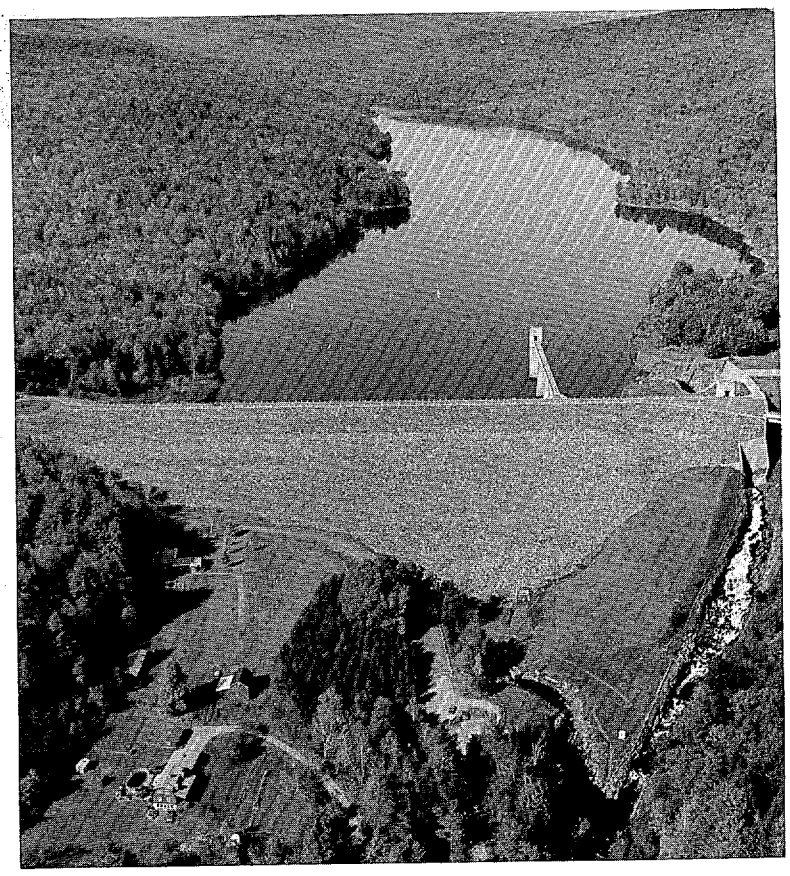
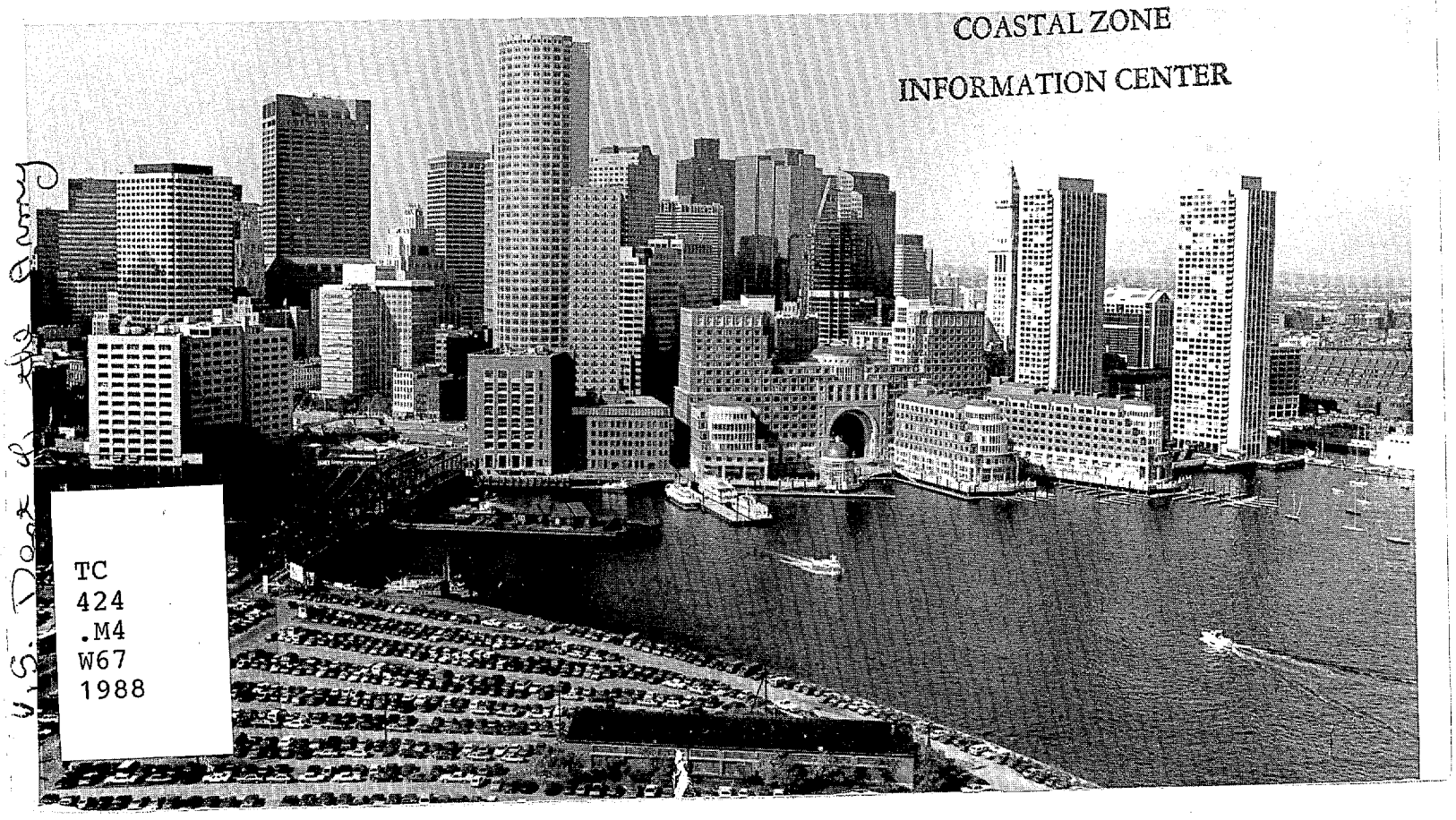
US Army Corps
of Engineers
New England Division

Water Resources Development in Massachusetts 1987







ON THE COVER: *Plum Island Beach in Newbury (top left) is a popular summer recreational area; since it was completed in September 1965, Littleville Lake (top right) in Huntington and Chester has prevented flood damages of $50 million; Boston Harbor is the largest seaport in New England and the principal distributing point for regional commerce.*

The work of the U.S. Army Corps of Engineers in Massachusetts 1987

This booklet presents a brief description of water resource projects completed by the U.S. Army Corps of Engineers in Massachusetts. It describes the role of the Corps in planning and building water resource improvements and explains the procedure leading to the authorization of such projects.

For ease of reference, the material is arranged according to the type of project, i.e. flood damage reduction, navigation, or shore and bank protection. There is also a reference at the end of the booklet that lists Corps' projects by community. A map showing the location of all Corps projects in the state is provided on the underleaf of this page.

The Corps of Engineers water resources development program exerts a significant impact on Massachusetts' physical, economic, and social environment. This publication affords citizens the opportunity to learn about the various projects and to determine how they can participate in decisions regarding present and future activities.

For further information, call the Corps of Engineers at 617-647-8777, or write:

U.S. Army Corps of Engineers
New England Division
Public Affairs Office
424 Trapelo Road
Waltham, MA 02254

US Army Corps of Engineers
New England Division

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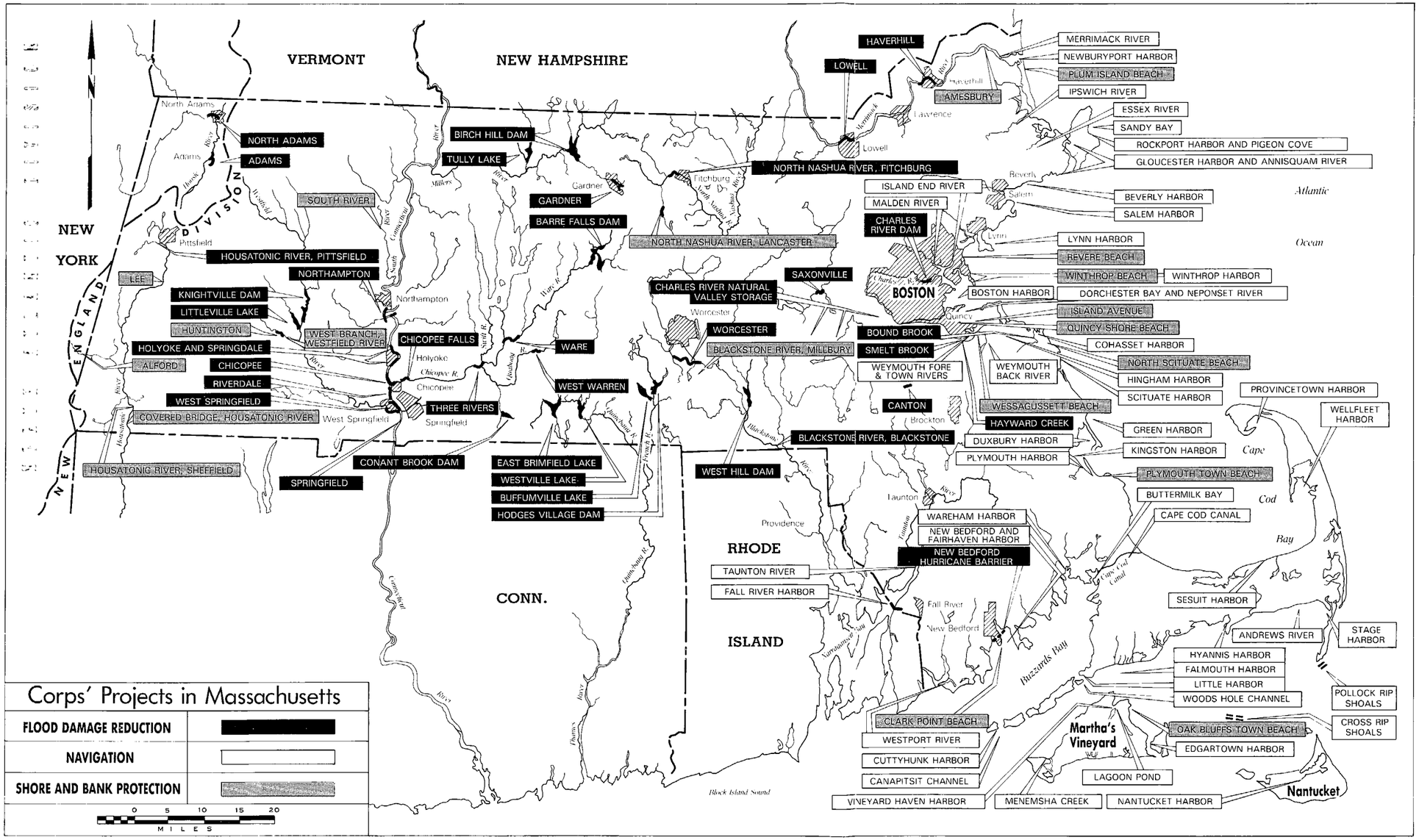

DEPARTMENT OF THE ARMY CORPS OF ENGINEERS, NEW ENGLAND DIVISION WALTHAM, MASS.

US Army Corps
of Engineers
New England Division

Leaders in Customer Care

Our nation's water resource program, as well as our Constitution, may well have been born on the banks of the Potomac River in the 1780s out of a disagreement between Virginia and Maryland.

Both states claimed jurisdiction over navigation on the Potomac and Pokemoke Rivers and the Chesapeake Bay. Under the Articles of Confederation, the Continental Congress did not have the power to resolve the dispute and regulate commerce. Fortunately, the states decided to meet and settle the matter. A convention was held at Mount Vernon in 1785, and again in Annapolis in 1786.

Out of those two meetings grew the belief that a strong central government was needed. At the very least, the Articles of Confederation needed to be amended. The convention attendees petitioned Congress in February 1787 and the Constitutional Convention was held in Philadelphia that May.

Thus, in celebrating the bicentennial of the United States Constitution this year, we are, in a way, celebrating the birth of our water resources program. The program encompasses port and river navigation improvements, flood damage reduction, beach erosion control, hydropower generation, water storage, development regulation in wetlands, and recreation. In all, the Corps manages almost 2000 water resource projects across the nation. It does this in cooperation with local interests and other federal agencies.

This year, the Corps has the additional challenges of the projects authorized by Public Law 99-662, the Water Resources Development Act of 1986. This act lays the foundation for water resources development for generations to come.

This booklet is one of a series detailing water resources programs in the 50 states and U.S. possessions. I hope you find it interesting and useful.

E.R. HEIBERG III
Lieutenant General, USA
Chief of Engineers

Enactment of the Water Resources Development Act of 1986 provides our nation with a framework for water resources development until well into the 21st century. The law has made numerous changes in the way potential new projects are studied, evaluated, and funded. The major change is that nonfederal cost sharing is specified for most Corps water resources projects. A new partnership now exists between the Federal Government and nonfederal interests that affords the latter a key role in project planning and allows the Federal Government to spread its resources over more water projects than would have been possible before.

With the passage of this law, the federal water resources program is in better shape than at any time in the past 16 years. The law authorizes over 260 new projects for inland navigation, harbor improvement, flood control, and shore protection—with additional benefits in water supply, hydropower, and recreation.

I hope this booklet gives you a glimpse of the extent, variety, and importance of the U.S. Army Corps of Engineers water resources development activities in your state.

JOHN S. DOYLE, JR.
Assistant Secretary of the Army
(Civil Works)

The Corps at a glance

Flood Damage Reduction	The Corps builds dams, hurricane protection barriers, and other structures that save lives and limit damage caused by floods. Nonstructural measures, such as floodproofing and wetland preservation, are also considered.
Navigation	In order to facilitate commercial trade and local commerce, the Corps maintains and improves the depths of harbors, rivers, and various waterways.
Shore and Bank Protection	Corps' projects retard erosion by restoring shores and beaches damaged by wind and water and stabilizing river-banks weakened by flooding.
Hydroelectric Power	As an alternative to nuclear power and oil-related energy sources, the Corps operates hydroelectric power plants at several of its flood control dams.
Natural Resources Management	At each of its dam and reservoir sites, the Corps protects woodlands and lakes that serve as important habitats for fish and wildlife. Many of these projects also provide the public with opportunities to enjoy swimming, hiking, camping, and other recreational activities.
Emergency Response and Recovery	When disaster strikes, the Corps stands ready to supplement state efforts by mobilizing its resources to provide quick and timely disaster relief assistance.
Other Programs and Services	The Corps controls aquatic plants that hinder navigation, ensures that water at its reservoirs meet stringent criteria, and lends its water resource expertise to state governments. More recently, the Corps has teamed up with the EPA to clean up hazardous wastes.

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U.S. Army Corps of Engineers Programs and Services

Introduction

Scope

The U.S. Army Corps of Engineers plays a major role in developing and managing our country's water resources. Corps projects reduce flood damage, facilitate navigation in rivers and harbors, protect streambanks and the coastline, generate hydroelectric power, provide outdoor recreational opportunities, and conserve and safeguard the environment. The water resource activities conducted by the Corps are as diverse as the needs of the public they serve.

This publication examines the role and responsibilities of the Corps in:

- Flood Damage Reduction
- Navigation
- Shore and Bank Protection
- Hydroelectric Power
- Natural Resources Management
- Emergency Response and Recovery

Roots

The Corps traces its history back to April 26, 1775, seven days after the first shots of the American Revolution were fired at Lexington, Massachusetts. Recognizing that the need for military engineering skill would be important in the war with England, the Massachusetts Provincial Congress appointed Boston native Richard Gridley to the rank of Colonel and chief engineer of the troops being raised in the colony.

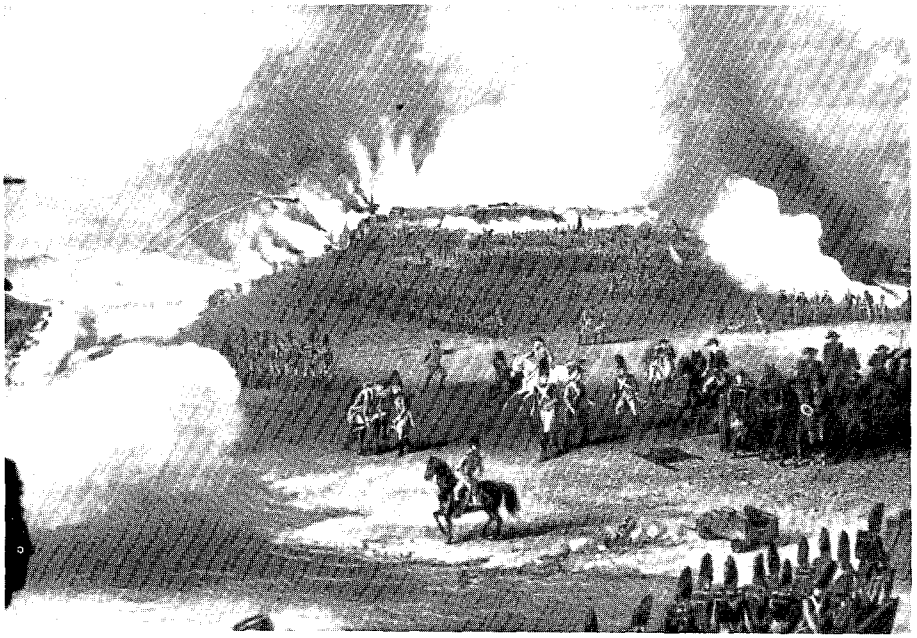
In the early morning hours of June 17, 1775, Gridley, working under the cover of darkness, constructed a well-designed earthwork on Breed's Hill that proved practically invulnerable to British cannon. The British eventually took the hill (later called the Battle of Bunker Hill) when the patriots ran out of gunpowder, but at a cost in casualties greater than any other engagement of the war.

Gridley was to play other critical roles in the early days of the Revolution. On the evening of March 4, 1776, Gridley, along with 2000 men and 360 oxcarts loaded with entrenching materials, moved into Dorchester Heights. By daylight, two strong protective barriers looked down at the British. An astonished General Howe, commander of the British forces, reportedly remarked that the Americans had done more in one night than his entire army would have done in six months. Exposed to the American batteries on Dorchester Heights and not strong enough to fight Washington's troops in other parts of Boston, the British army and fleet departed Boston on March 17, never again to occupy Massachusetts.

Most of the pre-Revolutionary War engineers in this country were British. Recognizing a need for American engineers to provide the expertise needed by a growing nation, Congress provided for a Corps of Cadets in 1802 to be educated at West Point, New York. This became the first engineering school in America and is now the United States Military Academy.

From the ranks of these first cadets came the Army engineers that explored the west; improved canals, waterways, and harbors; and built lighthouses, roads, bridges, and railways for rapidly expanding territories.

Under the direction of Colonel Richard Gridley, American patriots worked diligently throughout the early morning hours of June 17, 1775, designing a stout earthwork fortification that helped protect American soldiers from British cannonade in the historic Battle of Bunker Hill.

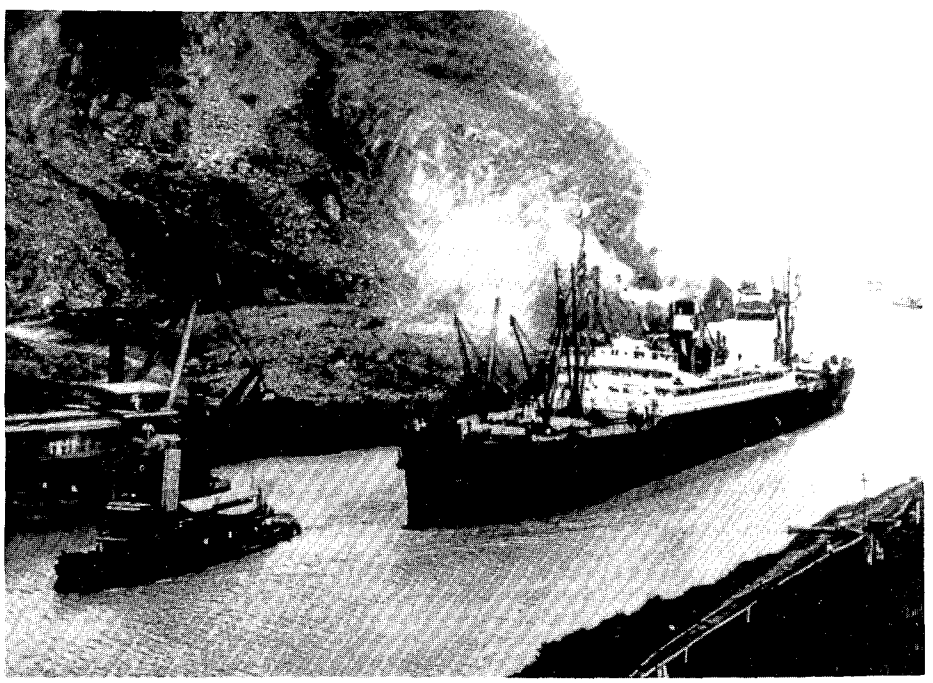


In the Battle of Bunker Hill, June 17, 1775, the British lost more men than in any other encounter of the Revolutionary War. The strategic defenses built by Colonel Richard Gridley and his men were instrumental in keeping American fatalities to a minimum.

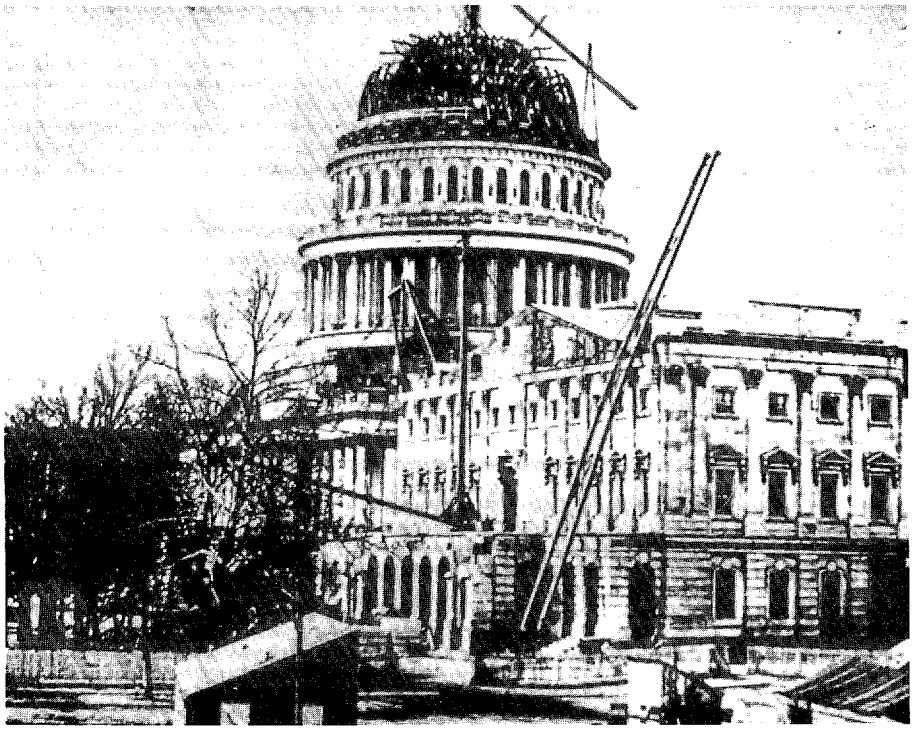
Today's Corps

The foresight and innovative spirit of the Corps' earliest days have served the public interest and contributed to America's rapid ascent to world leadership. Today, the Corps' civil works activities add to our quality of life and support our nation in many ways. In addition to water resource projects built both in America and abroad, such as the Panama Canal and the St. Lawrence Seaway, the Corps has constructed NASA facilities and provided military engineering support for our nation's allies. The Corps provides our armed forces with modern facilities to strengthen the country's defensive capability and ensure combat readiness. The military and civil (nonmilitary) works missions of the Corps complement each other, allowing our engineers to develop in peacetime the skills the nation would need in a defense mobilization or other national emergency.

There are 13 Corps division offices worldwide, 12 of which are located in the U.S., including one in New England. Civilian employees account for 98 percent of the Corps' civil works staff, with military officers and noncommissioned officers making up the remainder. The Corps' New England Division oversees a wide variety of engineering and construction activities in the six-state region (Western Vermont falls under the jurisdiction of the Corps' North



In August 1914, Army engineers—succeeding where two previous attempts failed—completed construction of the Panama Canal, connecting the Atlantic and Pacific Oceans. Construction of the canal's locks, dams, and piers, shown above, was an astounding engineering feat, and the canal stands today as a monument to the determination and skill of the Corps.



Army engineers contributed to both planning and construction of our nation's capital. When the Capitol Building had to be reconstructed in 1857, the Corps built two new wings and redesigned the dome with cast and wrought iron. The completed dome, which weighed almost nine million pounds, was used by President Abraham Lincoln during the Civil War as a symbol of his intention to preserve the Union.

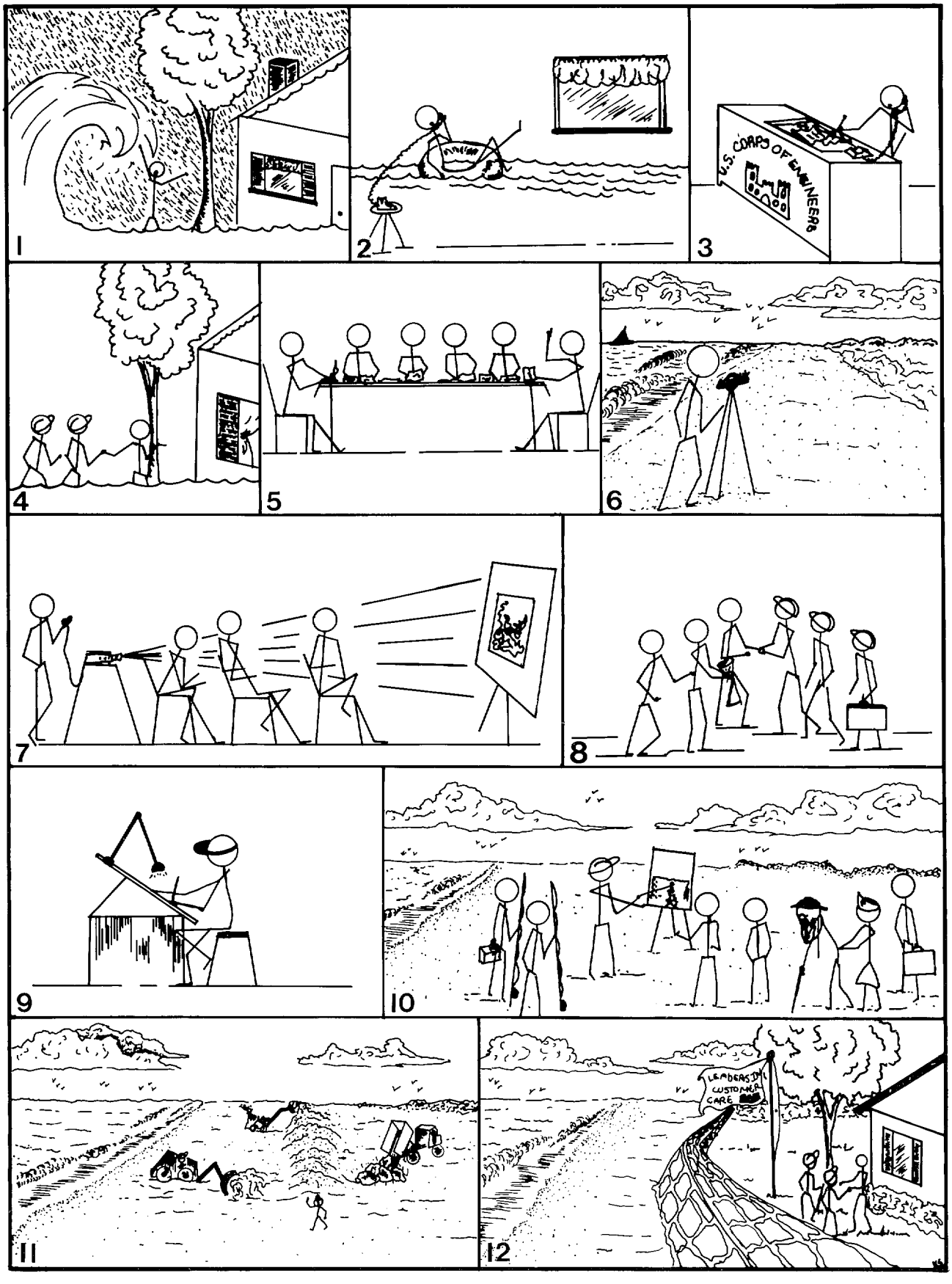
Atlantic Division). New England has 6100 miles of coastline and 19 principal river basins that lie entirely or partially within its borders. Although it represents only two percent of the nation's land area, New England contains nearly five percent (12 million) of the population. Its water resource needs reflect the diverse priorities of both urban and rural residents, and its four-season climate presents a wide variety of water resource challenges.

Project Formulation

There are several systematic steps involved in the implementation of every Corps of Engineers project. Local citizens or agencies normally first identify a water resource problem, such as persistent flooding or the need to improve a harbor. They contact the Corps or their congressional representative to discuss the problem. Upon receiving the request, Corps engineers will make a field visit to the area and verify the need. From this field visit and evaluation of other information, the Corps can determine whether the problem warrants Corps' participation and can be addressed with a small project, which does not require specific congressional authorization, or a large project, which must receive specific congressional authorization and appropriation of funds.

For a small project, the Corps will first conduct a reconnaissance study. This study examines a wide range of potential solutions, each of which is reviewed for its economic and engineering practicality, acceptability, and impact on the environment. Once completed, the reconnaissance phase findings are released to the public. The Corps then arranges cost-sharing agreements for further planning with the nonfederal sponsors, such as the local or state government or other public entity. When cost-sharing agreements are finalized, a Definite Project Report, which describes the recommended solution and includes an evaluation of the project's expected impacts, is prepared. After appropriate review from federal and state officials, nonfederal sponsors, and other public agencies, and approval by the Assistant Secretary of the Army for Civil Works, a project can then be designed and constructed. All small projects are planned, designed, and constructed under the Corps' Continuing Authorities Program.

There are several steps involved in the construction of Corps' projects, as illustrated on the following page. After citizens identify a water resource problem, such as persistent flooding (one), they contact the Corps of Engineers (two and three). Corps' officials then verify the need by visiting the affected area (four), and determine if the problem warrants Corps' involvement (five). If so, the Corps conducts a reconnaissance study (six), which examines a wide range of potential solutions, then releases those findings to the public (seven). Cost-sharing agreements for further planning are arranged with the nonfederal sponsors (eight). At this point, a Definite Project Report, which recommends a specific solution, is prepared (nine). After the report is reviewed and approved by all appropriate officials (ten), a project can then be designed and constructed (eleven). Corps' work stands as testimony to its theme, "Leaders in Customer Care" (twelve).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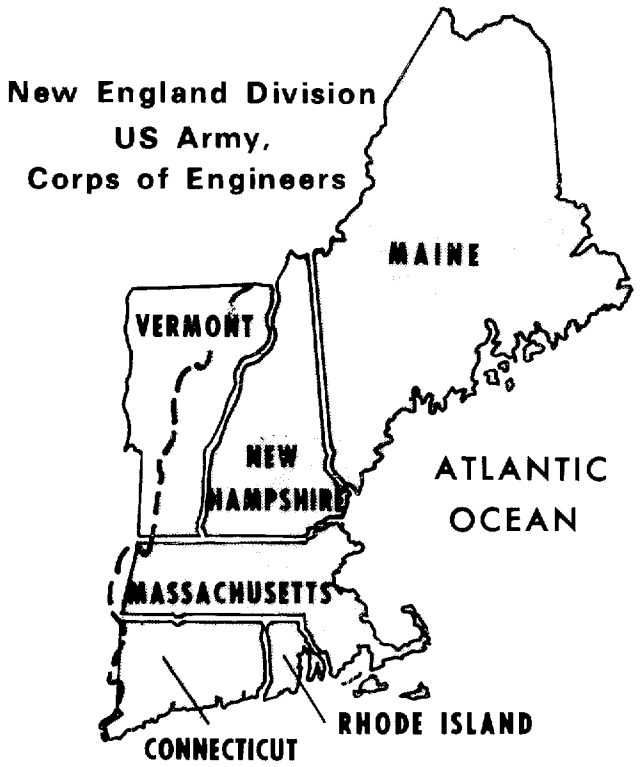


If a larger and more comprehensive project is warranted, a congressional resolution must first be obtained. This resolution authorizes the Corps to study and resolve the water resources problem. Congress then appropriates the funds required for the Corps to conduct a reconnaissance study. The rest of the planning process is similar to that of smaller projects. Construction of large projects, however, must be specifically authorized by Congress.

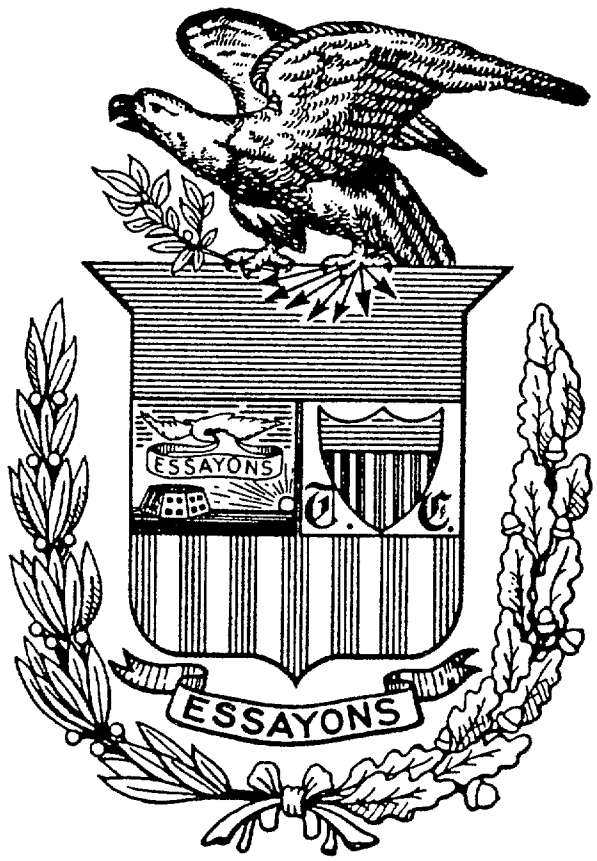
For all projects, large and small, the anticipated benefits must outweigh the economic and environmental costs of their implementation. The construction costs of all projects are shared between the federal government and non-federal sponsor, based on the project's purpose. Many projects designed and constructed by the Corps are turned over to municipalities or states for operation and maintenance.

A fundamental and vital part in the planning of all projects is public involvement. Public input often helps generate useful information and comment from local and state officials and other interested parties, such as fishermen, environmental organizations, and civic groups. In New England, the "town meeting" tradition is much in evidence through lively citizen involvement. The public has many opportunities to review and comment on Corps' project recommendations. Meetings, conferences, forums, and informal workshops are held with the public throughout the planning period. The concerns and expectations of the public and possible solutions are discussed and incorporated into all phases of project development.

The Corps of Engineers encourages full participation by the people and their elected officials and is committed to an open planning process. The Corps can only reach sound conclusions on the best use of water resources with the active involvement and strong support of the public, and takes pride in its theme for the 1980s, "Leaders in Customer Care."

Environmental Commitment

The Corps maintains a strong commitment to our environment. It strives for a proper balance between developing projects and conserving our country's natural resources in its search for the best possible solution to a water resource need.



The crest of the Army Corps of Engineers. The olive branch, held in the eagle's right claw, connotes the peaceful nature of the Corps' mission and its concern for the environment. The arrows, held in the left claw, indicate the Corps' readiness to defend the nation. The oak branch, lower right, stands for fortitude. The Corps' motto, "Essayons," means "Let Us Try."

In this regard, the Corps conducts its civil works program in full compliance with the National Environmental Policy Act (NEPA) of 1969. This law encourages a productive and enjoyable harmony between people and their environment and the understanding of how ecological systems and natural resources enrich our nation. The Corps upholds the spirit of NEPA with established planning principles, quality engineering standards, and professional operating procedures.

Concern for the integrity of the environment begins at the planning stage. All studies of proposed projects, as well as alternative plans, include an Environmental Assessment, which examines the impacts each potential solution may have on the environment. If the effects of a project on the area's ecology are expected to be significant, a more detailed Environmental Impact Statement may be prepared. All practical options and alternatives, including measures that preclude construction, are considered from the outset in selecting a solution that best resolves the water resources problem while protecting the quality of the environment. If the construction of a water resource project is the Corps' recommended option, the facility is carefully planned to minimize environmental damage. Consideration is given toward blending a project's features with the surrounding natural and man-made landscape.

Baker Cove in Groton, Connecticut, is a wetland that houses several different forms of life. Before building a proposed project in a given area, the Corps looks closely at the effects such a project may have on the environment and surrounding wetlands. The Corps considers all options, including those that preclude development, in finding a solution to a water resources problem.

Flooding in New England

Rain.

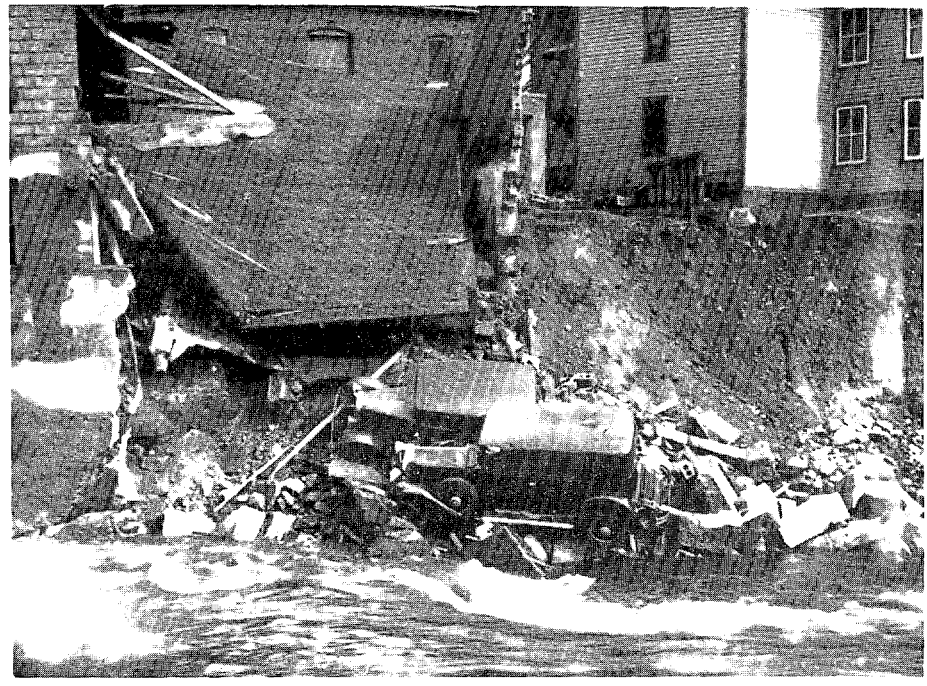
So important for the sustainment of life, rain enhances all living things. When it first begins to rain, the terrain absorbs the precipitation. Rivers and streams welcome rainfall's replenishing value.

Yet too much rain can be destructive. The saturated ground soon overflows. Rivers and streams, peaceful only days earlier, become swift-moving torrents. Cities and towns along the riverbanks fall victim to the onrushing water, which destroys everything in its path—automobiles, bridges, property, lives. Hurricanes can cause similar destruction, producing turbulent winds and heavy rains that lift the sea to a dangerous height several feet above normal.

New England has a long history of flooding. Through the years it has been hit with various storms that have caused millions of dollars in damages. Some of the more destructive hurricanes and floods the area has experienced since 1900 occurred in November 1927; March 1936; September 1938; September 1954; and August 1955. However, some of the highest flood levels in New England history occurred in April 1987 and gave many Corps dams their most serious test since they were built. Despite having six dams channel excess water through their emergency spillways because their reservoir capacity had been reached, the 35 dams under the jurisdiction of the Corps' New England Division held back billions of gallons of water that otherwise would have caused severe flooding downstream. The amount of water held back by these dams from this heavy rainfall was equivalent to a reservoir that could put the entire state of Rhode Island under more than one foot of water. Damages prevented by Corps flood control projects during the April 1987 storm amounted to $474 million.

The following pages depict some of the damages inflicted by these storms and explain why the Corps actively pursues its responsibilities to reduce flood damage.

1927 *Floodwaters swirl around homes and trees in this Vermont community during the November 1927 flood. The storm claimed 21 lives and caused $293 million in property damage.*

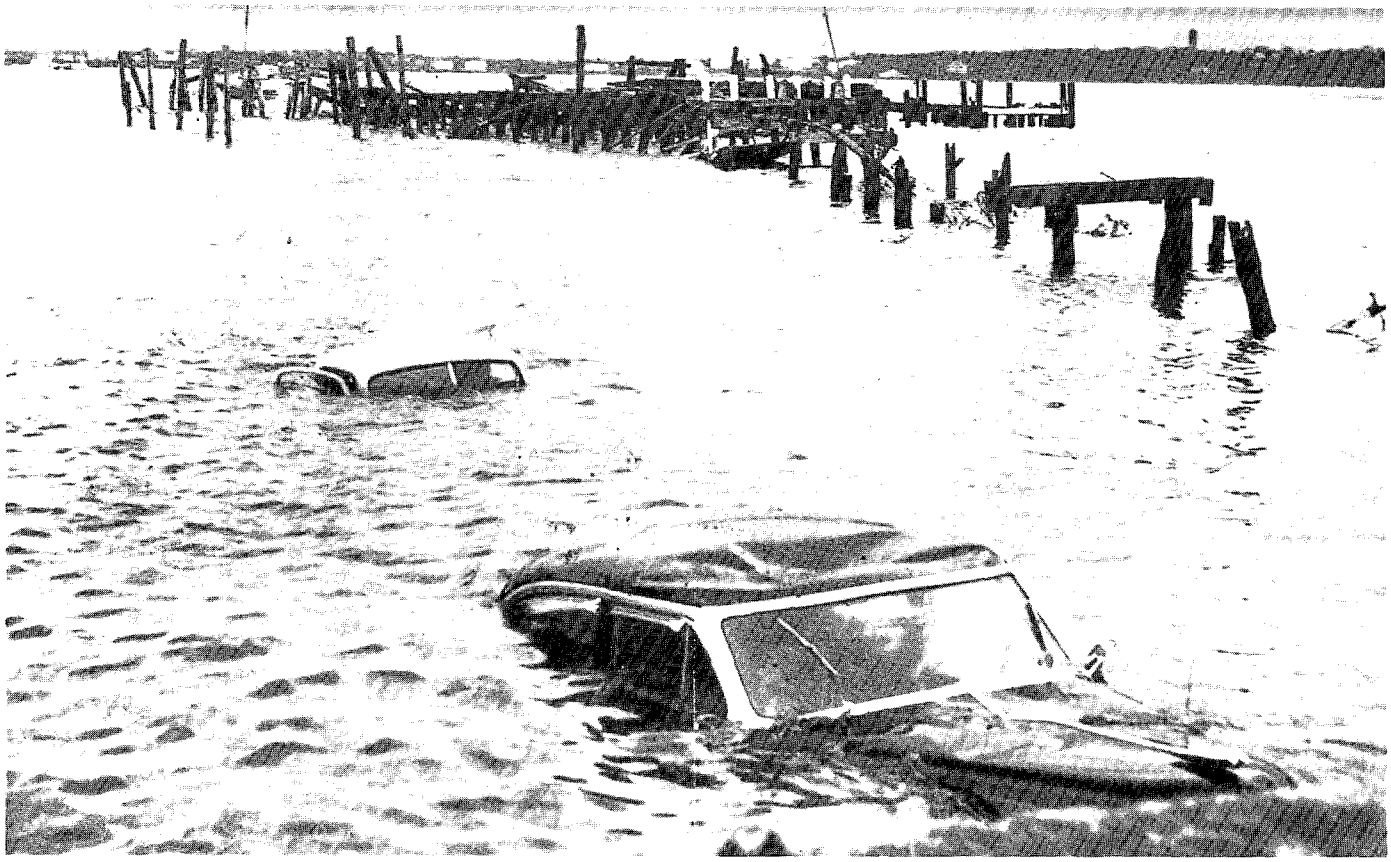


1936 *The rampaging waters of the North Nashua River ripped through the downtown area of Fitchburg, Massachusetts, during the March 1936 flood, taking with it homes, automobiles, and commercial and industrial property. Eleven lives were lost from this flood and damages were estimated at $66.4 million.*

1936 *Waters from the Connecticut River surround the Hartford South Meadows Power Station (center) and cover much of Hartford, Connecticut, during the March 1936 flood. The spring floods of 1936 brought widespread disaster from Maine to Maryland and helped mold political and public opinion that culminated in the Flood Control Act of 1936, which recognized the proper involvement of the federal government in flood control. (Copyright 1936* The Hartford Courant*).*

1938

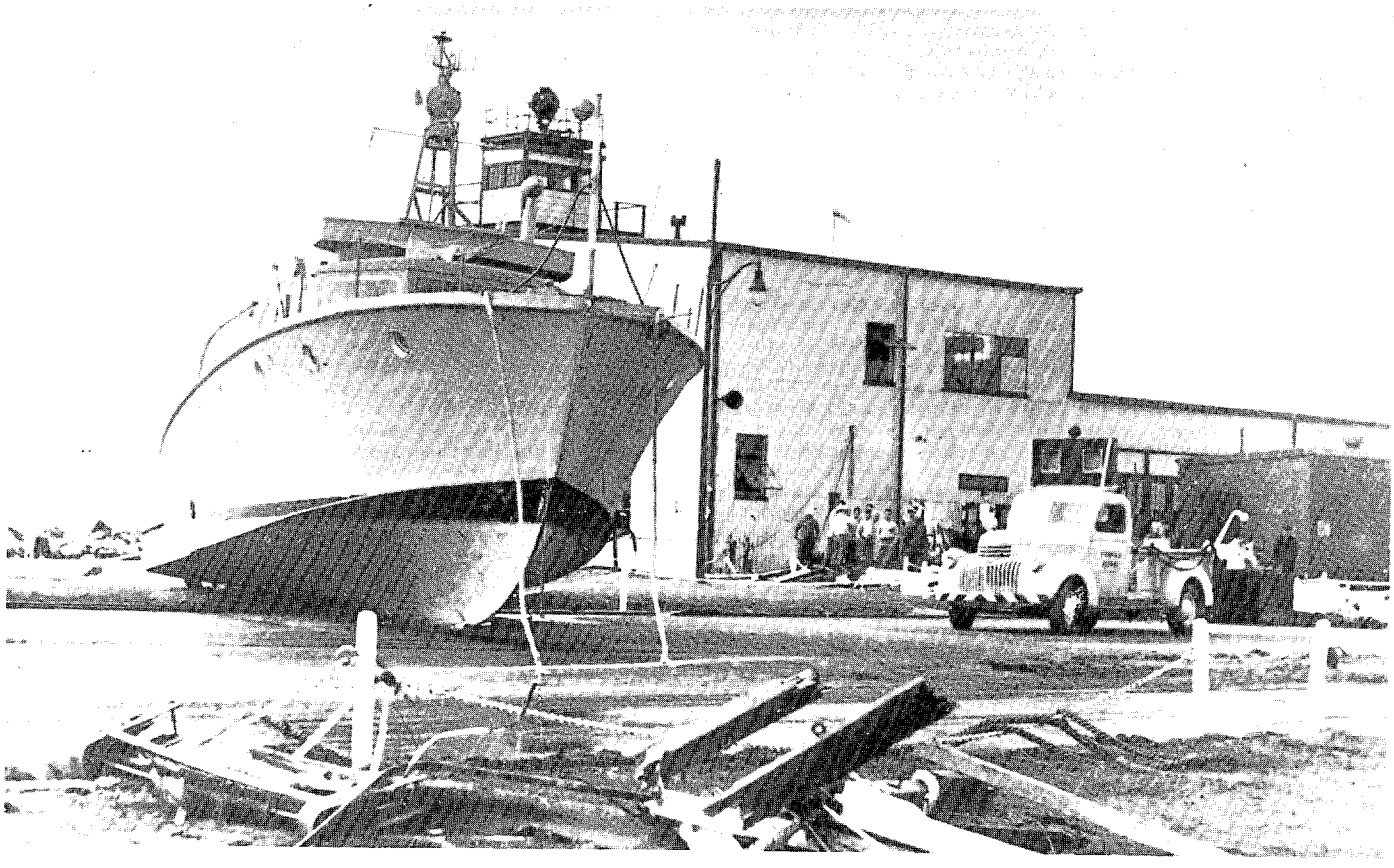
The heavy rains of the September 1938 hurricane caused the Contoocook River to flood a section of East Jaffrey, New Hampshire. This storm, with its 121 m.p.h. gusts, took the lives of eight people in New England and caused damages of $48.6 million (about $740 million in today's dollars).



1954

Hurricane Carol, which struck the New England coast in August 1954, caused damages estimated at $186 million ($685 million in today's dollars). The storm achieved its greatest fury in a band stretching from New London, Connecticut to the Cape Cod Canal. All that remains of the Rhode Island Yacht Club (above) in the Pawtuxet Neck section of Warwick, Rhode Island, is a cradle of piles after the structure was destroyed by Carol's high winds and waves. (Copyright 1954 The Providence Journal Company.*)*

1954 *A section of Providence lies under water from the rains of Hurricane Carol.*



1954 *The call "all ashore" was taken literally at the Quonset Naval Air Station in North Kingstown, Rhode Island, when Hurricane Carol whisked this air-sea rescue boat out of the water and on to Quonset Highway in August 1954. (Copyright 1954* The Providence Journal Company.*)*

1955 *The Blackstone River overflows its banks and floods several businesses and homes in Pawtucket, Rhode Island as a result of the heavy rains of Hurricane Diane in August 1955.*